



How do violations of Gricean maxims affect reading?



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ABSTRACT

Four eye-tracking experiments examined how violations of the Gricean maxim of quantity affect reading. Experiments 1 and 2 showed that first-pass reading times for size-modified definite nouns (*the small towel*) were longer when the modifier was redundant, as the context contained one rather than two possible referents, whereas first-pass times for bare nouns (*the towel*) were unaffected by whether the context contained multiple referents that resulted in ambiguity. Experiment 3 showed that unlike redundant size modifiers, redundant color modifiers did not increase first-pass times. Experiment 4 confirmed this finding, demonstrating that the effect of redundancy was dependent on the meaning of the modifier. We propose that initial referential processing is led by the lexico-semantic representation of the referring expression rather than Gricean expectations about optimal informativeness: Redundancy of a size-modifier immediately disrupts comprehension because the processor fails to activate the referential contrast implied by the meaning of the modifier, whereas referential ambiguity has no immediate effect, as it allows the activation of at least one semantically-compatible referent.

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Introduction

The primary function of referring expressions is to identify the referent intended by the language user. Some of the principles that may guide this process are Grice's (1975) maxims of conversation. Grice's maxims make the fundamental assumption that language comprehension is led by a default expectation that an utterance should be optimally informative. Most notably, the *maxim of quantity* states that language users are expected to provide as much information as necessary but no more information than needed. The *maxim of manner* also includes submaxims such as "Avoid ambiguity" and "Be brief (avoid unnecessary prolixity)". Under Grice's maxims, if more than one bird has been mentioned in the preceding context, an unmodified definite noun such as *the bird* can be taken to be infelicitous, as it underspecifies which bird is being referred to, creating referential ambiguity. When the context contains only one bird, however, the use of a modifier, as in *the large bird*, is also in conflict with the Gricean maxims, as the modifier overspecifies the referent's properties. Although these pragmatic principles may make intuitive sense, it is not clear whether or how real-time comprehension processes might be affected by them. As we review below, the main concern in previous research

has been how the referential context and the Gricean maxims help resolve syntactically ambiguous sentences. Subsequent off-line rating studies that examined the Gricean principles in the absence of syntactic ambiguity indicated that the conclusions from those studies may not generalize to sentences without syntactic ambiguity. The current study therefore focuses on the time-course with which the violations of the Gricean maxims influence online comprehension processes in syntactically unambiguous sentences, with the goal of uncovering the mechanisms that underlie referential processing more generally.

According to Grice (1975), violations of the maxims result in an inference or *conversational implicature*, whereby the literal meaning of the utterance is reconciled with the assumption that language producers are obliging the maxims. Hence, redundant descriptions may generate an implicature or inference about the language producer's rationale for the seemingly unnecessary information (e.g., the information may be important later in the story). Similarly, ambiguous reference would also prompt comprehenders to seek for a reason behind the language user's communicative intent for it (e.g., perhaps she or he does not wish to disclose which one is intended). But crucially, Grice's theory fails to specify whether such inferential processes delay the initial comprehension of the referring expression.

Early research on on-line referential processing was instigated by research on parsing. Specifically, Crain and Steedman (1985) proposed an account, dubbed *referential theory*, which explains

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how the referential context affects parsing decisions. They argued that language interpretation is guided by *referential presuppositions*: for example, a definite noun phrase *presupposes* that the referent is uniquely identifiable in the context (cf. Neale, 1990; Russell, 1905). In contrast, a modified definite noun phrase presupposes a set of referents, one of which is distinguishable from the rest by the property denoted by the modifier (cf. Olson, 1970; Osgood, 1971). Note that these presuppositions are in line with, if not subsumed under, Gricean expectations about optimal informativeness (see Clifton & Ferreira, 1989; Steedman & Altmann, 1989): i.e., the use of a modifier for a definite noun would be redundant, unless we presuppose that the context contains another similar referent. Importantly, referential theory claims that when a sentence allows multiple syntactic analyses, language comprehenders *immediately* adopt an analysis whereby these presuppositions are satisfied by the referential context. Some of the earliest evidence that supports such a claim comes from Altmann and Steedman (1988), who examined reading times for sentences such as (1):

- | | |
|------|---|
| (1a) | The burglar blew open the safe with the new lock. |
| (1b) | The burglar blew open the safe with the dynamite. |

The prepositional *with*-phrase in these sentences can modify the preceding noun phrase (*the safe*) or be part of the verb phrase *blew open the safe*. But the meaning of the *with*-phrase in sentence (1a) is more compatible with the noun phrase modifier analysis, whereas the meaning of the *with*-phrase in sentence (1b) is more compatible the verb phrase argument interpretation. Altmann and Steedman (1988) found that following a referential context that contained two safes, sentence (1b) was read more slowly than sentence (1a), which was taken to indicate that readers experienced difficulty when the meaning of the *with*-phrase was inconsistent with the referential context that supported the noun phrase modifier analysis. When the referential context contained only one safe, there was no reading time difference between the two sentences, though sentence (1b) was read faster in the one-safe context, where the verb phrase argument analysis avoided redundancy, than in the two-safe context, where the same analysis led to referential ambiguity. By adopting finer temporal measures, subsequent studies showed, in both written (e.g., Altmann, Garnham, & Dennis, 1992; Altmann, Garnham, & Henstra, 1994; Van Berkum, Brown, & Hagoort, 1999) and spoken language comprehension (e.g., Chambers, Tanenhaus, & Magnuson, 2004; Spivey, Tanenhaus, Eberhard, & Sedivy, 2002; Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995), that these effects occur *as soon as* comprehenders encounter the relevant referring expressions. For instance, Tanenhaus et al. (1995) recorded listeners' eye fixations to objects in the visual scene when they listened to instructions to carry out an action on those objects. When instructions such as (2a) were presented with a visual context of only one apple, an empty towel in the scene received increased fixations, which were time-locked to the onset of *on the towel*, suggesting that listeners initially analysed this phrase as the destination of the apple rather than as a modifier of *the apple*. Crucially, when the visual display contained two apples, one on a towel and the other on a napkin, there was no increase in the fixations to the empty towel following (2a) as compared to fixations in the syntactically unambiguous instruction (2b). These findings were taken to indicate that redundancy of *on the towel* in the one-referent context led to the misanalysis of the prepositional modifier as the destination of the instructed action, whereas referential ambiguity in the two-referent context favoured the noun phrase modifier interpretation, which in turn helped the correct parsing decision.

- | | |
|------|---|
| (2a) | Put the apple on the towel in the box. |
| (2b) | Put the apple that's on the towel in the box. |

The strong version of the Gricean hypothesis

Although these earlier studies were motivated by questions concerning syntactic processing, the important implication is that language comprehenders have fairly strong Gricean expectations about optimal informativeness, such that the referential context predisposes comprehenders to certain referring expressions over others, which is why the referential context exerts an immediate influence on syntactic analyses involving different referential forms. This raises the possibility that even in the absence of syntactic ambiguity, violations of Gricean expectations should disrupt comprehension immediately; upon encountering referring expressions that violate Gricean expectations because they provide too little or too much information, comprehenders will immediately experience difficulty. This assumed immediacy is an extension of Grice's (1975) original proposal, which did not specify exactly how referentially ambiguous or redundant descriptions should impair initial comprehension processes. Hence, we call it the *strong version of the Gricean hypothesis*.

However, other studies have shown that the effects of referential context on syntactic analyses are less strong (Ferreira & Clifton, 1986; Murray & Liversedge, 1994; Spivey & Tanenhaus, 1998; Zagar, Pynte, & Rativeau, 1997). Though such findings have been taken to support the view of the independence of syntactic processing from pragmatic constraints (e.g., Frazier, 1987), they also cast doubt over the strength of Gricean expectations and their impact during initial comprehension processes. Furthermore, recent off-line rating studies as well as research on anaphoric processing suggest that violations of the Gricean constraints do not always hinder comprehension. In the current study, we therefore propose and test two alternative hypotheses concerning how the different violations of the Gricean maxims might influence online comprehension processes, which we shall now discuss in turn.

Ambiguity first hypothesis

Using a similar set-up as in Tanenhaus et al. (1995), Engelhardt, Bailey, and Ferreira (2006) had participants rate the felicity of different spoken instructions in one of their experiments. Participants rated instructions that contained referential ambiguity (*Put the apple in the box* in the context of two apples) as less appropriate than instructions with a disambiguating post-nominal modifier (e.g., *Put the apple on the towel in the box* in the context of two apples), whilst they did not reliably rate instructions with a redundant modifier (e.g., *Put the apple on the towel in the box* in the context with only one apple) as less appropriate than instructions with no redundancy (*Put the apple in the box* in the context of only one apple). In a similar rating study, Davies and Katsos (2013) found that participants rated *both* ambiguous and redundant expressions as less natural than expressions that were neither ambiguous nor redundant, though participants rated ambiguous expressions as less natural than redundant expressions. Davies and Katsos argued that with ambiguous descriptions, the referent cannot be identified uniquely, whereas redundant descriptions do allow unique identification, so ambiguity is more problematic to comprehenders than redundancy. Furthermore, Arts, Maes, Noordman, and Jansen (2011) found that redundancy does not always hinder object identification; in some cases, it can even *facilitate* comprehension. For instance, when the description *round button* identified the referent uniquely, *round white button* neither hindered nor facilitated referent identification, and highly redundant descriptions like *large*

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